CENTRAL AGRICULTURAL UNIVERSITY, IMPHAL, MANIPUR

SELF STUDY REPORT
FOR

M. Tech. (Renewable Energy Engineering)

COLLEGE OF AGRICULTURAL ENGINEERING
AND POST HARVEST TECHNOLOGY, RANIPOOL,
GANGTOK

2019-20 to 2020-21

SUBMITTED TO
Indian Council of Agricultural Research,
Krishi Bhavan, New Delhi.

SUBMITTED BY
Central Agricultural University,
Imphal, Manipur- 795004

PREFACE

Energy is a key source of economic growth because all production and consumption activities (Agriculture, industry, domestic, transportation, service sectors) involve energy as a basic input.Conventional energy resources worldwide would seem to be infinite, but they are not, and there will come a time when there will be shortages. Pollution scenario worldwide is worsening every day, forcing people to look at less polluting alternatives to the world's energy demands. All these factors justify the need to have renewable energy resources, develop the necessary technology and create skill human resource in the field of renewable energy engineering.There is a huge and growing demand for energy thatôs ñreliable, cheap, and cleanò in world wide. Renewable energy is clean, affordable and reliable and has got the potential to counter poverty and climate change.

M.Tech. (Renewable Energy Engineering) prepares the students in theoretical and practical aspects of renewable energy technologies and its implementation, energy conservation, and management. Besides that, it also trains students in important areas of energy infrastructure, rational use of energy, energy policies and regulations, and energy-environment interface etc.Renewable energy engineering sector is growing rapidly due to the depleting conventional energy sources and the need of environmentally benign technologies. The branch of renewable energy contributes in promoting a cleaner and greener environment and also helping in addressing critical issue of energy security which is quite relevant in developing countries like India.This course is focus in the field of renewable energy engineering for the design and development of sustainable energy systems and energy efficient technologies for the future. Renewable energy and energy efficiency technologies is the key for creating a clean energy future for not only the nation, but the worldwide.

Due to the rising need for professionals and academics with a background and understanding in the Renewable Energy field, Central Agricultural University, Imphal started a new program at the Department of Renewable Energy Engineering, College of Agricultural Engineering and Post Harvest Technology, Ranipool, Gangtok, Sikkim. The University offers its students a well-equipped laboratory, containing state of the art equipment in various fields such as: Solar photovoltaic energy systems, solar thermal systems, biomass energy conversion systems, Biogas

technology, Solar PV water pumping systems and various equipments.The Renewable Energy Engineering program gives the students technical and practical aspects of energy use (technology and methodology of the study) and energy efficiency. The program also deals with minimizing the environmental impacts of energy use, as well as with energy economy and environmental policy.Renewable energy field has great potential for jobs of the future. There are numerous career opportunities in the area of renewable energy and energy conservation and management. Since the problems of environment, pollution and global warming are in forefront today, the Clean Development Mechanism (CDM) projects are gaining momentum all over the world with increased career opportunities in renewable energy and energy management. Renewable energies are changing the energy industry fast, creating a more diverse sector with huge opportunities for new technologies, new businesses and new ideas.

To produce world class Agricultural engineeringprofessionals who are equipped to meet the demands of global outfit, have analytical abilities and entrepreneurship for making career of self-employment and as contributors to livelihood and food/nutritional security, College of Agricultural Engineering and Post Harvest Technology (CAEPHT) was established by CAU in the year 2006 to addressthe issue of shortage of trained manpower (human resource) in the disciplines of agricultural engineering and post-harvest technology besides other issues, pertaining to natural resource management, farm mechanization, post-harvest technology, processing & value addition, utilization of renewable sources of energy, creation of agro-industries etc. in the region.The Govt. of Sikkim, through the Department of Food Security and Agricultural Development (FSADD) transferred the land of its Marchak Farm, Ranipool, East Sikkim to CAU, Imphal. Dr. N.L. Maurya, the then Director of Instruction, CAU, Imphal was appointed by university as Officer on Special Duty for establishment of CAEPHT and after his assuming this new assignment on May 20, 2006, the college started functioning with the admission of first batch of students in B. Tech. Agricultural Engineering programme. Prof. P.P. Dabral, is presently the Dean of the college since 2017 till date. CAEPHT is one of the constituent colleges which is functioning under the Central Agricultural University, Imphal, Manipur.The college offers undergraduate, postgraduate and Ph.D. courses and has the admission capacity of 43students from seven north eastern states and 10 ICAR seats for undergraduate students, 21 students for Masters programme in five departments and 4 students for Ph.D.degree programme in three department of the college annually. Students of this

college have excelled not only in curriculum but also in extracurricular activities and national level competitive examinations and the college is making continuous efforts to improve the quality of education offered here. The ICAR has introduced the procedure of accreditation, which help in assessing facilities available to impart the quality education offered by the college. The college was accredited by ICAR Peer Review committee for a period of **five years**. Since the college is due for further accreditation, the present report provides all the necessary information about the degree programme from year 2019-20 to 2020-21.

The departmental (College) level and University Level Task Force and Steering Committee have been gratefully acknowledged for their help, guidance and suggestions given in preparing the report. The departmental college level Steering Committee and Task Force have done a great job in compiling information and bringing out this report to be submitted to Accreditation Board of ICAR. My heartfelt thank to all those who are involved in preparation of this report.

CAEPHT, Ranipool — Dean

January, 2021 — (P.P. Dabral)

CONTENTS

6.4 Self-Study Report for M. Tech. (Agricultural Engineering) with Specialization in Renewable EnergyEngineering atCollege of Agricultural Engineering and Post Harvest Technology,Ranipool, Gangtok, Sikkim

6.4.1 Brief History of the Degree Programme

College of Agricultural Engineering and Post Harvest Technology, Ranipool was established during the year 2006 under the administration of Central Agricultural University, Imphal) to address the issue of shortage of trained manpower (human resource) in the disciplines of agricultural engineering and post-harvest technology besides other issues, pertaining to natural resource management, farm mechanization, post-harvest technology, processing & value addition, utilization of renewable sources of energy, creation of agro-industries etc. in the region.

The Department of Renewable Energy Engineering (DREE) focuses on teaching, research and extension in the field of renewable energy engineering for the development of sustainable energy systems and energy efficient technologies for the future. The department is actively involved in teaching of B. Tech. (Agricultural Engineering) & B. Tech. (Food Technology) and (Agricultural Engineering) with specialization in Renewable Energy Engineeringstudents, research in the field of solar thermal energy, solar photovoltaic energy, passive solar architecture, biomass energy, waste management, wind energy, hydro power, hydrogen production from renewable sources, fuel cell technology, energy audit, energy modeling, energy conservation and management, energy planning and policy and extension activities in diverse areas of renewable energy engineering.

The Department of Renewable Energy Engineering (REE) started offering M Tech (Agricultural Engineering) with specialization in Renewable Energy Engineering during the academic year 2019-20.The activity of the department includes the areas of renewable energy, energy conservation, farm energy management, auditing, development of efficient energy sources, and value addition of food products through renewable energy utilization.

Renewable Energy Engineering department gives exposures about different energy

sources like solar energy, wind energy, biomass energy, improved cookstoves, biomass briquetting, biogas technology, fuel cell technology and various alternate energy sources and various harnessing technologies, etc.

The Department of Renewable Energy Engineering (REE) is mainly engaged in teaching to under graduate and post graduate and Ph.D. students. It offers various courses of PG and PhD like Agro-energy Audit and management, Biomass energy sources and utilization of wastes, solar energy utilization, etc to M. Tech and PhD programmes run by various departments of College of Agricultural Engineering and Post Harvest Technology, Ranipool. Also, courses of REE offered by B. Tech (Agricultural Engineering) are also covered as per fifth Deanôs Syllabus. UG students are offered various projects in the VIII semester and experiential learning during VII semester.

The faculty of the department is actively engaged in academic, research as well as extension activities based on local and future needs of the farmers, field engineers and entrepreneurs. The faculty of the department has completed in total 9 research projects i.e., 6 Extra Mural Research Project and 3 Intra Mural Research Project. Presently the faculty of the department is handling 2 Intra Mural Research Project. The faculty members of the department have also designed and developed 09 renewable energy technologies (solar energy conversion technologies and biomass energy conversion technologies).The faculty members have published 100 research papers in journals and conference proceedings of national and international reputes and conference proceedings. The faculty members have also published 04 books on Renewable Energy and published 15 book chapters in the international and national reputed books. The faculty members have organized 26 International and National conferences, seminars, workshops, summer school and trainings.The department is continuously arranging various training and extension activities for farmers and officials and stakeholders. To date, 02 students are presently undergoing their M Tech (Agricultural Engineering) with specialization in Renewable EnergyEngineering in the department.

Statistics of Master's degree programme (2019-20 to 2020-21)

Year of Admission	Admitted			Dropped			Passed			Degree award during the year	Remarks
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total		
2019-2020	1	0	1	-	-	-	-	-	-	2021-2022	Yet to

											complete
2020-2021	**1**	**1**	**2**	**-**	**1**	**1**	**-**	**-**	**-**	**2022-23**	**Yet to complete**
Total	**2**	**1**	**3**		**1**	**1**	**0**	**0**	**0**		

Award of CAU, GOI & ICAR authorities' Scholarships

M.Tech.(REE)	**Scholarship Type**			
	University Scholarship (CAU)	**ICAR scholarship(NTS)**	**SC/ST Fellow Ship**	**GOI Scholarship (SC+ST)**
2019-20	**1**	**0**	**-**	**-**
2020-21	**1**	**0**	**-**	**-**
TOTAL	**2**	**0**	**-**	**-**

6.4.2. FACULTYSTRENGTH

Faculty Strength

Department	**Sanctioned Faculty**			**Faculty in place**			**Vacant position**			**Recommended by ICAR**		
	Prof.	**Assoc. Prof.**	**Asst. Prof.**	**Prof.**	**Assoc. Prof.**	**Asst. Prof.**	**Prof.**	**Assoc. Prof.**	**Asst. Prof.**	**Prof.**	**Assoc. Prof.**	**Asst. Prof.**
REE	0	2	3	1*	0	3	0	1	0	**1**	**2**	**3**
Total	0	2	3	1*	0	3	0	1	0	1	2	3

**Promoted through CAS*

6.4.3. TECHNICAL AND SUPPORTINGSTAFF

Sl. No.	**POST**	**Sanctioned**	**Filled**	**Vacant**
1.	Lab. Assistant	2	2	0
2.	Messenger(MTS)	2	2	0
	Total	**4**	**4**	**0**

6.4.4. CLASSROOMS AND LABORATORIES:

Classrooms

Sl. No.	Class room No.	Area (sq. m)	Seating capacity	Other facilities (LCD, Projectors, Computers, Smart board etc.)
1.	PG classroom: 1	16.00	8	Whiteboard and Computer Facility

Laboratory

The Renewable Energy Engineering department has 4 laboratories to carry out UG/ PG practical as well as PG research. All the laboratories are well equipped with all facilities to carry out research.

Sl. No.	Name of the laboratory	Area (sq.m)
1.	Renewable Energy ï Bioenergy Laboratory	145
2.	Renewable Energy Laboratory- Solar Yard Section 1 and 2	75.00 each
3.	Renewable Energy Field Laboratory with Polyhouse and Poly tunnel dryer	85.00
4.	Physics Laboratory	95.00

Major equipment

1. Agni-star Gasifier
2. Air Quality Meter
3. Air Quality Monitor with Laptop
4. Aluminium Pots
5. Bio-gas Analyzer
6. Biogas Lamp
7. Biomass Cookstove
   i. Natural Draft biomass cookstove
   ii. Forced Draft biomass cookstove
8. Bomb-Calorimeter
9. Box-type Solar Cooker
10. Cloud and Pour Point Apparatus
11. Cookstoves with Air Insulation
12. Data logger
34. Hot wire Anemometer
35. IDB Gasifier stove (Ceramic)
36. IDB Gasifier Stove (Smokeless)
37. Improved downdraft biomass combustion device
38. Indirect type solar cabinet dryer
39. Lux meter
40. Mixed mode type solar dryer
41. Muffle furnace
42. Multichannel digital temp. indicator
43. Orsat Apparatus
44. Parabolic Dish Solar Cooker
45. pH meter
46. Pressure Gauge
47. Pyranometer
48. Ried Vapor Pressure Test apparatus
49. Shakti-Surahi Biomethanation plant
50. Small scale box type biochar kiln

13. Digital Anemometer 14. Digital Balance (15 kg) 15. Digital Lux meter 16. Digital Multimeter 17. Digital PH meter 18. Digital Stop watch 19. Digital Tachometer 20. Digital Temperature Indicator 21. Digital Thermo-hygrometer 22. Digital Thermometer Non-contact type 23. Digital Wood moisture meter 24. Direct Type Solar Dryer 25. Double distillation Apparatus 26. Electric air blower 27. Electric weighing balance 28. Gas flow meter Glass 29. thermometer 30. Glass water distillation 31. Hand operated briquetting machine 32. High Precision balance 33. Hot Air oven	51. Solar Concentrator Training Kit 52. Solar Cooker Box type 53. Solar Lantern 54. Solar Power Photovoltaic training Kit 55. Solar Refrigerator 56. Solar Still 57. Solar Street light system 58. Solar water pumping system 59. Sound level meter 60. SPV Home lighting System 61. Sunshine Recorder 62. Test setup for thermosiphon system type solar water heater 63. Thermocouple base thermometer with display unit 64. Turbine type flow meter 65. Water bath shaker 66. Weighing balance 67. Wood moisture meter

Average Number of Students in Theory and Practical Classes

Postgraduate students are less in number and are grouped into one theory batch and one practical batch.

Sl. No.	Name of the department	Theory Batch	Practical Batch
1.	Renewable Energy Engineering	Full strength	Full strength

6.4.5. CONDUCT OF PRACTICAL AND HANDS-ON-TRAINING

Course curriculum for master degree programme has been designed with special emphasis on novel areas of Renewable Energy engineering. Further as a part of their course curriculum, the PG students are taken to exposure visits to different research institutes, progressive farmersô field, private industries and state government agencies. Industry/ Institute Trainings as a part of their course curriculum is mandatory for the students. Several exposure visits organized by department is also contributing for better understanding of the subject and to enrich their practical knowledge.

Laboratories of Department of Renewable Energy Engineering

Renewable Energy Laboratory

Renewable energy Field Laboratory-1

Renewable energy Field Laboratory-2

Polyhouse and Poly tunnel dryer

Physics Laboratory

Glimpses of Practical's and exposure visits

Demonstration of Solar Cooker

Extension training programme of farmers

Extension training programme of farmers

Students performing practical in field

	laboratory
	
Students performing practical in bioenergy laboratory	**Students taking readings for Project**

Students undergoing experiential learning at Assam Lingzey

PG students performing Practicals

Solar trainer kit exercises | **Field polyhouse cultivation of tomato**

Demonstration activities in Kisan Mela | **Registration of training programmes**

6.4.6. SUPERVISION OF STUDENTS IN PGPROGRAMME

Sl. No.	Year	Department of Renewable Energy Engineering	No. of PG recognized teachers		Student to teacher ratio		
			For M. Tech	Total Available faculty	M.Tech. Students admitted	M. Tech students remained due to attrition	
1.	**2019-20**		03	04	01	01	1:3
2.	**2020-21**		03	04	02	01	1:3

6.4.7. FEEDBACK OF STAKEHOLDERS (STUDENTS,PARENTS, INDUSTRIES, EMPLOYERS, FARMERSETC.)

College has kept suggestion and complaints box in college premises. Regular counseling meetings are organized and in emergency parents are also participated for the personality developments of students. This college has provided an excellent platform and infrastructure to establish rapport between students and teachers. The farmers, entrepreneurs and trainees from various Government, Private and public sector units, stakeholders and unemployed youth coming to various programme provide feedbacks through open platform available at programmes, through feedback books, emails, WhatsApp and available platforms. These feedbacks are taken righteously and proper discussion and action is taken by concerned persons and college authorities time to time.

6.4.8. STUDENT INTAKE AND ATTRITION IN THE PROGRAMME FOR LAST FIVEYEARS

Year wise information on sanctioned strength, actual intake and attrition during the last five years of the Degree Programme are furnished in the tabular form. This attrition is due to students getting regular jobs in their respective state government etc.

Thestudent discontinued their degree programme due to appointment in State govt. jobs or opting for civil service examinations.

Year	Departments	Sanctioned seats	Actual intake	Attrition	Attrition Percentage
2019-20	Renewable Energy	3	1	0	0

2020-21	Engineering	3	2	1	50

6.4.9. ICT APPLICATION IN CURRICULADELIVERY

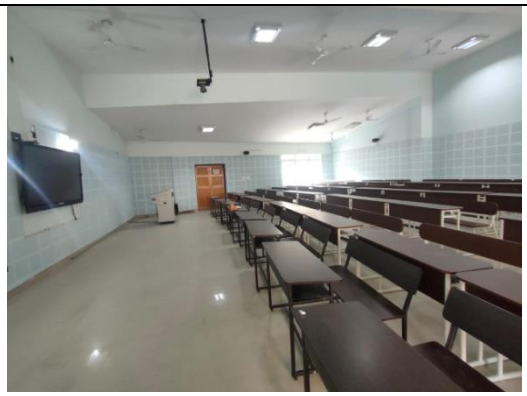
Interactive whiteboards and touch based computer system:

The College of Agricultural Engineering and Post-Harvest Technology (CAEPHT) Computer Laboratory, under Central Agricultural University (CAU), Imphal, is well-equipped with 2 smart classrooms having facilities of Interactive whiteboards for conduction of online lectures and smart board allows projection of images, manipulation of images, dragging, clicking and copying of matter. Simultaneously Teacher is availed with facility to provide handwritten notes on board and same can be saved for later use.

Computer facilities:

The College of Agricultural Engineering and Post-Harvest Technology (CAEPHT) Computer Laboratory, under Central Agricultural University (CAU), Imphal, is well-equipped with 20 computers for computing facilities to all the students of the college, teaching and non-teaching staff members along with Internet connectivity. It also provides Internet facilities to all teaching staff, administrative staff and all students of the college. There are approximately more than 300 users who are availing the Internet and computing facilities.

The Computer Centre supports a wide 1000 Mbps fiber optic network (OFN) that connects all the academic units, hostels, library, dispensary, residence and other central facilities to the Computer Centre. Users can use the computing resources of Computer Center from their offices, academics unit, hostels and residences. Login is provided to all the students, faculty and staff members for Internet browsing. Besides, Wi-Fi facility is provided to boysô hostel, girlsô hostel, ATIC Building, guest house, dispensary, VC camp, and Deanôs residence. LAN is provided through optical fiber connection in North Academic building, South Academic building, new girlsô hostel, auditorium, staff quarter, medical unit and Farmers Produce Processing cum Skill Development Centre. The network Security is Provided through UTM/Firewall.



Smart Classroom

Language Lab

Computer Lab

6.4.10. The information pertaining to 6.4.1 to 6.4.9 has been provided for PG programme *i.e.,* M.Tech. (Agricultural Engineering) in Renewable Energy Engineering of College of Agricultural Engg & PHT, CAU, Ranipool Gangtok Sikkim, Sikkim is correctly.

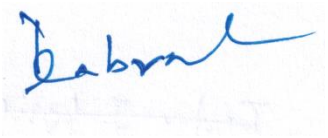
6.4.11. Since the accreditation of Programmes is related to the All India Admission from ICAR and also having weightage for College accreditation, therefore the data presented in the section 6.4 is liable to the verification at any stage.

6.4.12

CERTIFICATE

I the Dean, P. P. Dabral, College of Agricultural Engineering & Post Harvest Technology, Ranipool, Sikkim, hereby certify that the information contained is furnished as per the records available in the college and degree awarding university.

Date:



(P. P. Dabral)

Dean